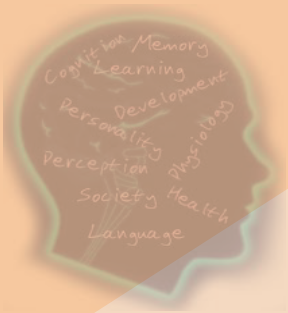
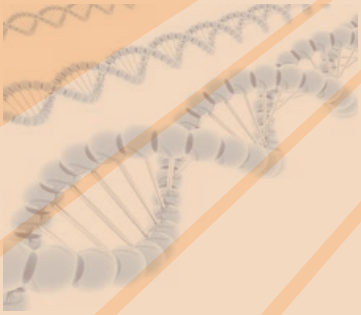
BMI Brain-Mind Institute

FOR FUTURE LEADERS OF BRAIN-MIND RESEARCH

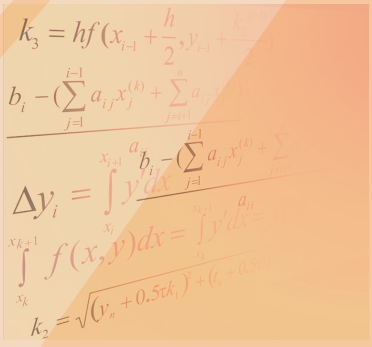


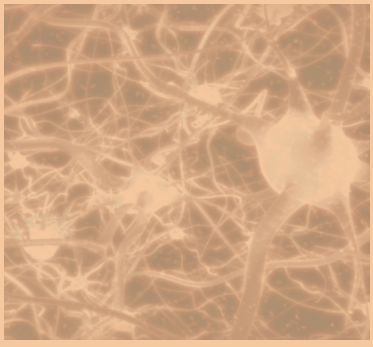


Program of 2013 BMI the Second International Conference on Brain-Mind

July 27-28

East Lansing, Michigan USA





BMI Press

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Messages From the Chairs

2013 is the second year of the Brain-Mind Institute (BMI) and the International Conference on Brain-Mind (ICBM).

April 2, 2013, President Barack Obama announced his Brain Initiative. The European Union has announced the Human Brain Project. China is preparing its own brain project. Understanding how the brain works is one of the last frontiers of the human race. The era where humans can understand how their brains work seems to have arrived, although any understanding of the nature is always an approximation. When a model can predict observed data well, the model is a good approximation in terms of the observed data.

The subject of brain-mind is closely related to all activities of the human race. For this reason, BMI started an earlier platform that treats every human activity as a part of science, including, but not limited to, biology, neuroscience, psychology, computer science, electrical engineering, mathematics, intelligence, life, laws, policies, societies, and politics. The scientific community faces great opportunities and challenges, ranging from communication to education, to research and to outreach. BMI tries to serve the scientific community and public.

After offering BMI 821 Biology for Brain-Mind Research, BMI 821 Neuroscience for Brain-Mind Research, and BMI 871 Computational Brain-Mind in 2012, this year BMI offered BMI 871 Computational Brain-Mind and BMI 831 Cognitive Science for Brain-Mind Research. We would like to thank Fudan University for hosting the BMI 871 classes 2012 and 1013 and Michigan State University for hosting the BMI 811 and BMI 821 in 2012, and BMI 831 in 2013. BMI courses were offered in two forms, live classes and distance-learning classes. BMI plans to host BMI courses and ICBM at more international locations in the future.

As a multi-disciplinary communication platform for exchanging latest research ideas and results, ICBM is an integrated part of the BMI program. ICBM 2013 includes invited talks, talks from submitted papers, and talks from submitted abstracts. From this year, ICBM talks will be video recorded and available publicly through the Internet.

The brain-mind subjects are highly multidisciplinary. The BMI Program Committee tries to be open-minded in review of submissions. This open-mindedness is necessary for the broad nature of brain-mind education and research.

Welcome to East Lansing!

Jiaguo Qi, Program Co-Chair
George Stockman, Program Co-Chair
Yang Wang, Program Co-Chair
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- Dr. David C. Zhu, Michigan State University

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International Conference on Brain-Mind 2013

Preliminary Program at a Glance

Day 1, Saturday July 27th

Room 1420 Biomedical and Physical Science Building

08:45-09:15	**Registration**
09:15-09:30	**Opening Messages**

Day 1 AM Session

Chair: Gonzalo Munevar

09:30-10:30	**Invited Talk:** **Neural Coding and Decoding: An Overview of the Neuroscience and Neurophysiology behind Intracortical Brain-Computer Interfaces.** Speaker: Beata Jarosiewicz *(Brown University)*
10:30-11:00	**Break**
11:00-11:40	**Skull-Closed Autonomous Development: WWN-7 Dealing with Scales** Speaker: Xiaofeng Wu *(Fudan University)*

11:40-12:00	**Motor Neuron Splitting for Efficient Learning in Where-What Network** Speaker: Zejia Zheng *(Michigan State University)*
12:00-14:00	**Lunch**
	Day 1 PM Session Chair: Beata Jarosiewicz
14:00-15:00	**Invited Talk:** **Resting-State fMRI and Applications** Speaker: David C. Zhu *(Michigan State University)*
15:00-15:30	**Break**
15:30-16:30	**Invited Talk:** **Examining the Effects of Avatar-body Schema Integration** Speaker: Rabindra (Robby) Ratan *(Michigan State University)*
16:30-17:10	**Serious Game Modeling of Caribou Behavior across Lake Huron Using Cultural Algorithms and Influence Maps** Speaker: Robert G. Reynolds *(Wayne State University)*
18:00-20:00	**Reception** (All invited)

Day 2, Sunday, July 28th

Room 1420 Biomedical and Physical Science Building

Day 2 AM Session

Chair: Juyang Weng

09:00-10:00	**Invited Talk:** **BrainGate: Toward the Development of Brain-Computer Interfaces for People with Paralysis.** Speaker: Beata Jarosiewicz *(Brown University)*
10:00-10:30	**Break**
10:30-11:10	**Establish the three theorems: DP Optimally Self-Programs Logics Directly from Physics** Speaker: Juyang Weng *(Michigan State University)*
11:10-11:30	**Neuroscientific Critique of Depression as Adaptation** Speakers: Gonzalo Munevar and Donna Irvan *(Lawrence Technological University)*
11:30-13:30	**Business Lunch Meeting** (All invited)

	Day 2 PM Session Chair: Taosheng Liu
13:30-14:30	**Invited Talk:** **Obama's Brain Initiative and Resistance from the Status Quo** Speaker: Juyang Weng *(Michigan State University)*
14:30-15:10	**Neural Modulation for Reinforcement Learning in Developmental Networks Facing an Exponential No. of States** Speaker: Hao Ye *(Fudan University)*
15:10-15:40	**Break**
15:40-16:40	**Invited Talk:** **Representation of Attentional Priority in Human Cortex** Speaker: Taosheng Liu *(Michigan State University)*
16:40-17:20	**The Ontology of Consciousness** Speaker: Eugene M. Brooks *(Providence Hospital)*

Program

Day 1 AM Session

Saturday July 27th 09:30-10:30

Neural Coding and Decoding: An Overview of the Neuroscience and Neurophysiology behind Intracortical Brain-Computer Interfaces.

Speaker: Beata Jarosiewicz *(Brown University)*

Abstract

Conditions such as brainstem stroke, spinal cord injury, and amyotrophic lateral sclerosis (ALS) can disconnect the brain from the rest of the body, leaving the person awake and alert but unable to move. Conventional assistive devices for people with severe motor disabilities are inherently limited, often relying on residual motor function for their use. Brain-computer interfaces (BCIs) aim to provide a more powerful signal source by tapping into the rich information content that is still available in the person's brain activity. A crucial component of BCIs is the ability to record neural activity and decode information from it. In this lecture, I will give an overview of the neuroscience and neurophysiology behind neural coding and decoding, drawing examples from well-studied brain systems such as the visual system, the hippocampal place cell system, and the motor system.

Short Biography

Dr. Jarosiewicz is an Investigator in Neuroscience at Brown University in Providence, RI. She received her Ph.D. in 2003 in the laboratory of William Skaggs at the University of Pittsburgh and the Center for the Neural Basis of Cognition, characterizing the activity of place cells in a novel physiological state in the rat hippocampus. She did postdoctoral research with Dr. Andrew Schwartz at the University of Pittsburgh, where she studied neural plasticity in non-human primates using brain-computer interfaces, and then with Dr. Mriganka Sur at MIT, where she used 2-photon calcium imaging to characterize the properties of ferret visual cortical neurons with known projection targets. She joined the BrainGate research team at Brown University in 2010, where she is applying her neuroscience expertise to help develop practical intracortical brain-computer interfaces for people with severe motor disabilities.

Saturday July 27th 11:00-11:40

Skull-Closed Autonomous Development: WWN-7 Dealing with Scales

Speaker: Xiaofeng Wu *(Fudan University)*

Abstract

The Where-What Networks (WWNs) consist of a series of embodiments of a general-purpose brain-inspired network called Developmental Network (DN). WWNs model the dorsal and ventral two-way streams that converge to, and also receive information from, specific motor areas in the frontal cortex. Both visual detection and visual recognition tasks were trained concurrently by such a single, highly integrated network, through autonomous development. By "autonomous development", we mean that not only that the internal (inside the "skull") self-organization is fully autonomous, but the developmental program that regulates the growth and adaptation of computational network is also task non-specific. This paper focused on the "skull-closed" WWN-7 in dealing with different object scales. By "skull-closed", we mean that the brain inside the skull, except the brain's sensory ends and motor ends, is off limit throughout development to all teachers in the external physical environment. The concurrent presence of multiple learned concepts from many object patches is an interesting issue for such developmental networks in dealing with objects of multiple scales. Moreover, we will show how the motor initiated expectations through top-down connections as temporal context assist the perception in a continuously changing physical world, with which the network interacts. The inputs to the network are drawn from continuous video taken from natural settings where, in general, everything is moving while the network is autonomously learning.

Saturday July 27th 11:40-12:00

Motor Neuron Splitting for Efficient Learning in Where-What Network

Speaker: Zejia Zheng *(Michigan State University)*

Abstract

Biologically-inspired developmental Where-What Network gives an elegant approach to the general visual attention-recognition (AR) problem. In their work, Luciw and Weng build the visuomotor network for detecting and

recognizing objects from complex backgrounds, modeling the dorsal and ventral streams of the biological visual cortex.

Although WWN models the visual cortex to model the attention and segmentation process in visual cortex, the effects of neuromodulator, such as serotonin and dopamine, on individual neurons in the brain are challenging to understand and model, largely because each neuron in an emergent network does not have a static, task-specific meaning. Weng and coworkers modeled the effects of serotonin and dopamine on motor neurons and inner brain neurons in emergent networks as discouragement and encouragement of the firing of neurons, as a statistical effect on the related network behaviors.

Directly combining the motivational system with where-what network is plausible but not computationally efficient. The motivational system makes educated guesses for a given foreground object. Where-What Network, on the other hand, requires training in both location motors and type motors. Combining these the two motors will generate a large number of confusing outcomes that takes the network forever to be trained even for a moderate resolution in the location motors.

In this work, we integrate the system with the where-what network based on a coarse to fine learning strategy. Instead of being explicitly informed about the location and type information of the foreground object, which is used in supervised WWN learning, and guessing the correct location and type until correct, which is used in motivated developmental network, the network is rewarded to learn to refine its output on a gradual basis.

The network is first trained to learn rough locations of the foreground object. The network architecture then splits its motor neurons into four exactly same neurons to learn to recognize in higher precision. The new neurons copies the weights and connections of its parent neuron. The four new motor neurons represents four sub-locations of the parent neuron. The network then goes through training process once again to refine those copied neurons. More splitting and training would take place if higher precision is required.

This approach reduces training time thus allows us to train the network efficiently using real time experiment platforms. Experimentally, the recognition rate of the new network is comparable to the original supervised learning network. This approach is also proved to be efficient when applied to type motor.

Day 1 PM Session

Saturday July 27th 14:00-15:00

Resting-State fMRI and Applications

Speaker: David C. Zhu *(Michigan State University)*

Abstract

Recently, resting state-fMRI (rs-fMRI) has emerged as an effective way to investigate brain networks. In this technique, fMRI data is acquired when an individual is asked to do nothing but stay awake while lying in the MRI scanner. The rs-fMRI technique emerged from the phenomena that approximately 95% of the brain's metabolism occurs because of spontaneous neuronal activity. The blood-oxygen-level-dependent (BOLD) fMRI signal indirectly measures the spontaneous neural activity. Therefore, the correlation of BOLD signal time courses between two brain regions at rest infers the functional connectivity between them. The fMRI signals from random brain activity are removed from correlations over a reasonably lengthy fMRI time course. Recent studies have demonstrated the potential applications of rs-fMRI in understanding the functional connectivity in the brains of both healthy individuals and neurological patients. In this talk, I will describe the underlying mechanism of resting-state fMRI and discuss potential applications.

Short Biography

I have 17 years of MRI research and development experience, including 13 years after I completed my Ph.D. degree in biomedical engineering at University of California, Davis. I developed my expertise in MRI physics and engineering during my graduate research and my subsequent work in GE Healthcare. After spending three years at University of Chicago as a research faculty member, I joined the faculty at Michigan State University in 2005. With other faculty members, we developed the Cognitive Imaging Research Center, and I have been supporting its growth in a role of an MRI physicist and the lead of the support team. I currently serve as an MRI physicist for the Cognitive Imaging Research Center (CIRC), and the Departments of Radiology and Psychology at Michigan State University. I also serve on the faculty of MSU Neuroscience and Cognitive Science programs. I am responsible for the

technical aspect of CIRC. I have collaborated extensively with MSU psychologists and neuroscientists who are interested in using MR neuroimaging methods. Two of my research focuses are to study the functional and structural connectivity of brains affected by Alzheimer's disease and by concussion.

Saturday July 27th 15:30-16:30

Examining the Effects of Avatar-body Schema Integration

Speaker: Rabindra (Robby) Ratan *(Michigan State University)*

Abstract

There is a growing body of research about the outcomes of using virtual avatars (and other mediated self-representations). For example, the Proteus Effect suggests that people behave in ways that conform to their avatars' characteristics, even *after* avatar use, e.g., using taller avatars leads to more social confidence (Yee & Bailenson, 2007). But there is little research on how the cognitive experience of using the avatar influences such effects. This talk will argue that just as humans are able to integrate complex tools into body schema (Gallivan et al., 2013), we can also integrate avatars into body schema. Doing so requires a high level of proficiency controlling the avatar, which many people attain through modern gaming interfaces. I argue that such integration of the avatar into body schema fundamentally modifies the effects of using the avatar. Somewhat counter-intuitively, my research suggests that avatar-body schema integration weakens post-use Proteus effects because it detracts from relevance of the avatar's identity characteristics and also augments the salience of *dis*connection from the avatar after use. I will present supporting data from an experiment using psychophysiological measurements, describe a second similar experiment that is currently underway, and discuss possible experimental designs with functional MRI to address this research question. ** I should note that I am a media-technology scholar, not a neuroscientist nor an expert in the neural mechanisms of tool-body schema integration, so I welcome feedback from the neuroscience community and am open to collaboration with interested parties.

Short Biography

Rabindra ("Robby") Ratan's research focuses primarily on the psychological experience of media use, with an emphasis on video games and other interactive environments (e.g., the road) that include mediated self-representations (e.g., avatars, automobiles). He is particularly interested in how different facets of mediated self-representations (e.g., gender, social identity) influence the psychological experience of media use, and how different facets of this psychological experience (e.g., avatar-body schema integration, identification) affect a variety of outcomes, including cognitive performance, learning, health-related behaviors (e.g., food choice, driving aggression), and prejudicial/prosocial attitudes.

Methodologically, his work mostly includes experiments that utilize video game-based stimuli with psychophysiological and survey measures, as well as analyses of behavior-log databases (from games and other media) linked to surveys provided by users. Most recently, he has been developing games (with game-design students from the TISM department) that include potential experimental manipulations relating to research questions of interest (e.g., the effect of avatar characteristics on learning and post-play motivations) . He plans to use these games in his studies as well as to release them to the general public.

Saturday July 27th 16:30-17:10

Serious Game Modeling of Caribou Behavior across Lake Huron Using Cultural Algorithms and Influence Maps

Speaker: James Fogarty *(Wayne State University)*

Abstract

Recent surveys of a stretch of terrain underneath Lake Huron have indicated the presence of a land bridge which would have existed 10,000 years ago, during the recession of ice during the last Ice Age, connecting Canada and the United States. This terrain, dubbed the Alpena-Amberley land bridge, was host to a full tundra environment, including migratory caribou herds. Analysis of the herds, their potential behavior and the likely areas of their movement

would lead researchers to the locations Paleo-Indians would pick for hunting and driving the animals

The application designed around these concepts used Microsoft's .Net platform and XNA Framework in order to visually model this behavior and to allow the entities in the application to learn the behavior through successive generations. By utilizing an influence map to manage tactical information, and cultural algorithms to learn from the maps to produce path planning and flocking behavior, paths were discovered and areas of local concentration were isolated. In particular, paths emerged that focused on efficient migratory behavior at the expense of food consumption, which caused some deaths. On the other hand paths emerged that focused on food consumption with only gradual migration process. Then here were also strategies that emerged that blended both goals together; making effective progress towards the goal without excessive losses to starvation.

Saturday July 27th 18:00-20:00 Reception

Day 2 AM Session

Sunday, July 28th 09:00-10:00

BrainGate: Toward the Development of Brain-Computer Interfaces for People with Paralysis.

Speaker: Beata Jarosiewicz *(Brown University)*

Abstract

Our group, BrainGate, aims to restore independence to people with severe motor disabilities by developing brain-computer interfaces (BCIs) that decode movement intentions from spiking activity recorded from microelectrode arrays implanted in motor cortex of people with tetraplegia. This technology has already allowed people with tetraplegia to control a cursor on a computer screen, a robotic arm, and other prosthetic devices simply by imagining movements of their own arm. In this lecture, I will present an overview of BrainGate's ongoing research efforts, and I will discuss my efforts toward bringing the system closer to clinical utility by automating the self-calibration of the decoder during practical BCI use.

Short Biography

Dr. Jarosiewicz is an Investigator in Neuroscience at Brown University in Providence, RI. She received her Ph.D. in 2003 in the laboratory of William Skaggs at the University of Pittsburgh and the Center for the Neural Basis of Cognition, characterizing the activity of place cells in a novel physiological state in the rat hippocampus. She did postdoctoral research with Dr. Andrew Schwartz at the University of Pittsburgh, where she studied neural plasticity in non-human primates using brain-computer interfaces, and then with Dr. Mriganka Sur at MIT, where she used 2-photon calcium imaging to characterize the properties of ferret visual cortical neurons with known projection targets. She joined the BrainGate research team at Brown University in 2010, where she is applying her neuroscience expertise to help develop practical intracortical brain-computer interfaces for people with severe motor disabilities.

Sunday, July 28th 10:30-11:10

Establish the three theorems: DP Optimally Self-Programs Logics Directly from Physics

Speaker: Juyang Weng *(Michigan State University)*

Abstract

In artificial intelligence (AI) there are two major schools, symbolic and connectionist. The Developmental Pro- gram (DP) self-programs logic into a Developmental Network (DN) directly from physics or data. Weng 2011 [6] proposed three theorems about the DN which bridged the two schools: (1) From any complex FA that demonstrates human knowledge through its sequence of the symbolic inputs-outputs, the DP incrementally develops a corresponding DN through the image codes of the symbolic inputs-outputs of the FA. The DN learning from the FA is incremental, immediate and error-free. (2) After learning the FA, if the DN freezes its learning but runs, it generalizes optimally for infinitely many image inputs and actions based on the embedded inner-product distance, state equivalence, and the principle of maximum likelihood. (3) After learning the FA, if the DN continues to learn and run, it "thinks" optimally in the sense of maximum likelihood based on its past experience. This paper presents the proofs.

Sunday, July 28th 11:10-11:30

Neuroscientific Critique of Depression as Adaptation

Speaker: Gonzalo Munevar (Lawrence Technological University*)*

Abstract

We will discuss evidence from neuroscience against the hypothesis that depression is cognitively adaptive. Andrews and Thompson propose that depression allows for more analytical and focused thinking about our most serious personal problems. It is thus adaptive in a way analogous to disease responses such as fever, which gives an advantage to white cells over pathogens. It is unpleasant but advantageous. Evidence from neuroscience, however, cast doubt on this hypothesis. Some of the key areas involved in the

neuroanatomical circuit of depression, such as the prefrontal cortex (reduced volume in the left hemisphere), the dorsal anterior cingulate cortex (decreased activity) and the cortical hippocampal path (disrupted communication), when adversely affected, lead instead to impaired memory and concentration.

Sunday, July 28th 11:30-13:30 Business Lunch Meeting

Day 2 PM Session

Sunday, July 28th 13:30-14:30

Obama's Brain Initiative and Resistance from the Status Quo

Speaker: Juyang Weng *(Michigan State University)*

Abstract

In this talk, I will first provide an overview about the challenges that Obama's Brain Initiative raised to the US government and the scientific community. It is well recognized that neuroscience has been productive but is rich in data and poor in theory. Still, it is natural but shortsighted for a government officer to approach only well-known experimental neuroscientists for advice on the Brain Initiative. I argue that it is impractical for experimental neuroscientists to come up with a comprehensive computational brain theory, because brain activities are numerical and highly analytical, which require extensive knowledge in analytical disciplines such as computer science, electrical engineering and mathematics. However, the status quo in those analytical disciplines still fall behind greatly, not only in terms of knowledge required to address the problems of the Brain Initiative, but also in terms of the persistent resistance toward brain subjects cause by the very human nature. Currently, almost all scholars, whether on the natural intelligence side or the artificial intelligence side, are highly skeptical about, and resisting, any comprehensive computational brain theory. The human race in its modern time is repeating the objections to new science like those toward Charles Darwin's theory of

evolution. Open-minded communication and debates seem to be necessary to avoid taxpayer's money being unwisely spent on only incremental work.

Short Biography

Juyang (John) Weng is a professor at the Department of Computer Science and Engineering, the Cognitive Science Program, and the Neuroscience Program, Michigan State University, East Lansing, Michigan, USA. He received his BS degree from Fudan University in 1982, his MS and PhD degrees from University of Illinois at Urbana-Champaign, 1985 and 1989, respectively, all in Computer Science. His research interests include computational biology, computational neuroscience, computational developmental psychology, biologically inspired systems, computer vision, audition, touch, behaviors, and intelligent robots. He is the author or coauthor of over two hundred fifty research articles. He is a Fellow of IEEE, an editor-in-chief of *International Journal of Humanoid Robotics* and an associate editor of the new *IEEE Transactions on Autonomous Mental Development*. He has chaired and co-chaired some conferences, including the NSF/DARPA funded Workshop on Development and Learning 2000 (1st ICDL), 2nd ICDL (2002), 7th ICDL (2008), 8th ICDL (2009), and INNS NNN 2008. He was the Chairman of the Governing Board of the International Conferences on Development and Learning (ICDLs) (2005-2007, http://cogsci.ucsd.edu/~triesch/icdl/), chairman of the Autonomous Mental Development Technical Committee of the IEEE Computational Intelligence Society (2004-2005), an associate editor of *IEEE Trans. on Pattern Recognition and Machine Intelligence*, an associate editor of *IEEE Trans. on Image Processing.*

Sunday, July 28th 14:30-15:10

Neural Modulation for Reinforcement Learning in Developmental Networks Facing an Exponential No. of States

Speaker: Hao Ye *(Fudan University)*

Abstract

Suppose that a developmental agent (animal or machine) has c concepts to learn and each concept has v possible values. The number of states is then vc, exponential in the number of possible concepts. This computational complexity is well known to be intractable. In artificial intelligence (AI), human handcrafting of symbolic states has been adopted to reduce the number of states, relying on human intuition about the required states of a given task. This paradigm has resulted in the well-known high brittleness because of the inability of the human designer to check the validity of his state reduction for the system to correctly go through an exponential number of paths of state transitions (e.g., in graphic models). In this reported work, we study how a Developmental Network (DN) as an emergent and probabilistic finite automaton (FA) that enables its states to emerge automatically — only those that are experienced in its "life" — greatly reducing the number of actual states. In order to avoid the requirement for the human teacher to specify every state in online teaching (i.e., action in DN), we allow the human teacher to give scores to evaluate the displayed actions (i.e., reinforcement learning), modeling the serotonin system for punishments and the dopamine system for rewards. Due to the need of ground truth for performance evaluation which is hard to come by in the real world, we used a simulation environment described as a game setting, but the methodology is applicable to a real-world developmental robot and also our computational understanding how an animal develops its skills.

Sunday, July 28th 15:40-16:40

Representation of Attentional Priority in Human Cortex

Speaker: Taosheng Liu (Michigan State University)

Abstract

Humans can flexibly select certain aspects of the sensory information for prioritized processing. How such selection is achieved in the brain remains a major topic in cognitive neuroscience. In this talk, I will examine the neural mechanisms underlying both spatial and non-spatial selection. I will review evidence that space-based selection is controlled by dorsal frontoparietal areas that encode spatial priority in topographic maps, whereas feature- and object-based selection also rely on similar brain areas. These areas modulate neural activity in early visual areas to enhance the representation of task-relevant information. Furthermore, a recent study from our group found that spatial and feature-based priority forms a hierarchical structure in frontoparietal areas such that similar selection demands recruit similar neural activity patterns. These results suggest that the representation of attentional priority utilizes a computationally efficient organization to support flexible top-down control.

Short Biography

Taosheng Liu received his PhD in Cognitive Psychology from Columbia University and postdoctoral training at the Johns Hopkins University and New York University. He is now an Assistant Professor in the Department of Psychology at Michigan State University. Taosheng Liu's research interests are in the cognitive neuroscience of visual perception and attention, working memory, and decision making. His main experimental techniques include using psychophysics and eyetracking to measure behavior and using functional magnetic resonance imaging (fMRI) to measure human brain activity. Current research in his lab focuses on the representation of feature- and object-based attentional priority in the brain, how attention affects perception, and the neural mechanism of value-based decision making. More information can be found online at http://psychology.msu.edu/LiuLab.

Sunday, July 28th 16:40-17:20

The Ontology of Consciousness

Speaker: Eugene M. Brooks *(Providence Hospital)*

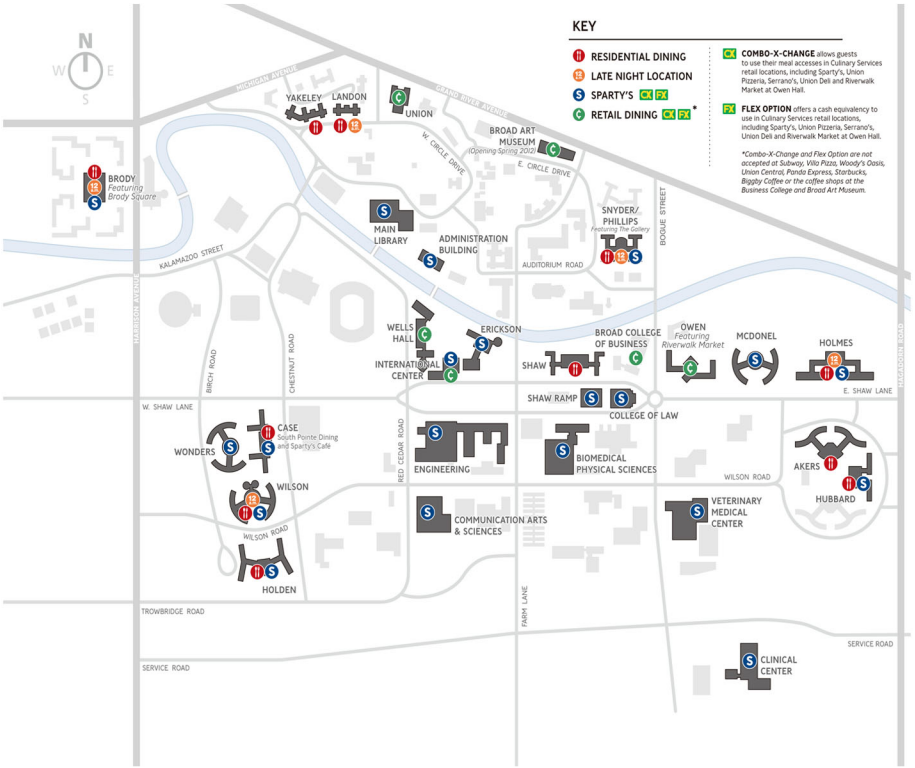
Abstract

As postulated by myself in previous articles, transgenic research has empirically demonstrated that particular proteins are central in the ontology of consciousness. The research results support the contention that consciousness is physical. An explanation is given of the process in which consciousness takes place.

Author Index

Local Information for ICBM 2013 Attendants

Where to eat ?



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For more information, please visit eatatstate.com

EAT AT EAST LANSING

Hey, who doesn't like to hear the words, "Let's Eat!" Around here it's no exception and you'll never believe the variety of dining options available. From family dining to chic tapas bars, you'll find that food for every taste, budget and style is right at your fingertips. We list some options inside the boarders of MSU. Enjoy!

- *Bell's Greek Pizza*. 1135 E Grand River Ave, East Lansing, MI 48823-4659. Cusines: Pizza
- *Peanut Barrel Restaurant*. 521 E Grand River Ave, East Lansing, MI 48823-4404. Cuisines: American
- *Swagath Indian Cuisine.* 1060 Trowbridge Rd, suite 3, East Lansing, MI 48823-5248. Cuisines: Indian
- *Sansu.* 4750 S Hagadorn Rd, Ste 100, East Lansing, MI 48823-5377. Cuisines: Japanese
- *Sushi YA* 124 W Grand River Ave, East Lansing, MI 48823. Cuisines: Japanese
- *Georgio's Pizza*. 120 Charles St, East Lansing, MI 48823-4343. Cuisines: Pizza
- *State Room.* 55 S Harrison Rd, East Lansing, MI. Dining options: Breakfast/Brunch, Reservations
- *Copper*. 2874 Lake Lansing Rd., East Lansing, MI. Cuisines: American Good for: Romance, Special occasions
- *El Azteco.* 225 Ann St, East Lansing, MI 48823-4320 Cuisines: Mexican
- *Beggar's Banquet.* 218 Abbott Rd, East Lansing, MI 48823-4340.
- *Gumbo and Jazz.* 1133 E Grand River Ave, East Lansing, MI 48823-4659. Cuisines: Cajun & Creole

Because we want you to get out and around, maps of East Lansing and downtown Lansing is attached in the appendix. There are also numerous delicious restaurants in downtown Lansing area. Visit lansing.org/visitor/restaurants for more choices.

How to get around ?

TOUR AROUND THE CITY

For a quick trip around the city, hop on a CATA bus. The Capital Area Transportation Authority (CATA) offers convenient bus routes throughout Lansing. Out for a night on the town and don't feel like driving? CATA's Entertainment Express trolley is your connection between downtown Lansing and East Lansing's entertainment district. Cabs and limos are available as an alternative to public transportation.

CAPITAL CITY AIRPORT

Going for a longer trip? The Capital City Airport has added more direct flights from major cities with direct service from Atlanta, Orlando and D.C. The Airport also offers a variety of car rental services. For those who prefer to stay on the ground, Lansing is also located on the beautiful Midwest Amtrak train route. There are also various taxi and limo rental services in the Lansing area to serve you.

RIVERTRAIL

Bikers, runners, walkers, and inline skaters will want to check out Lansing's Rivertrail. The Rivertrail covers more than 8 miles from Old Town Lansing in the north, through Riverfront Park downtown and extends through the campus extends through the campus of MSU to the east.

Where to visit ?

MUSEUMS

- *The Michigan Historic Center and Library.* Houses the State Library in one wing and museum in the other. In the center is a live White Pine, the state tree.
- *Michigan State University Museum.* The Museum, located on the campus of MSU in the old library, houses a large collection of dinosaur bones and other artifacts.
- *MSU-Kresge Art Museum.* The Kresge Art Museum is in the heart of the MSU campus on the Red Cedar River. The Museum houses a small collection and will soon be replaced by a new modern art museum on Grand River.

HISTORIC BUILDINGS

- *Michigan State Capital.* The Capital has been beautifully restored and sits in the heart of downtown Lansing surrounded by beautiful mid-rise buildings of Michigan's golden auto years. Today it is a National Historic Landmark.
- *Turner Dodge House.* Built in 1858, this beautiful and meticulously maintained home is available for tours.

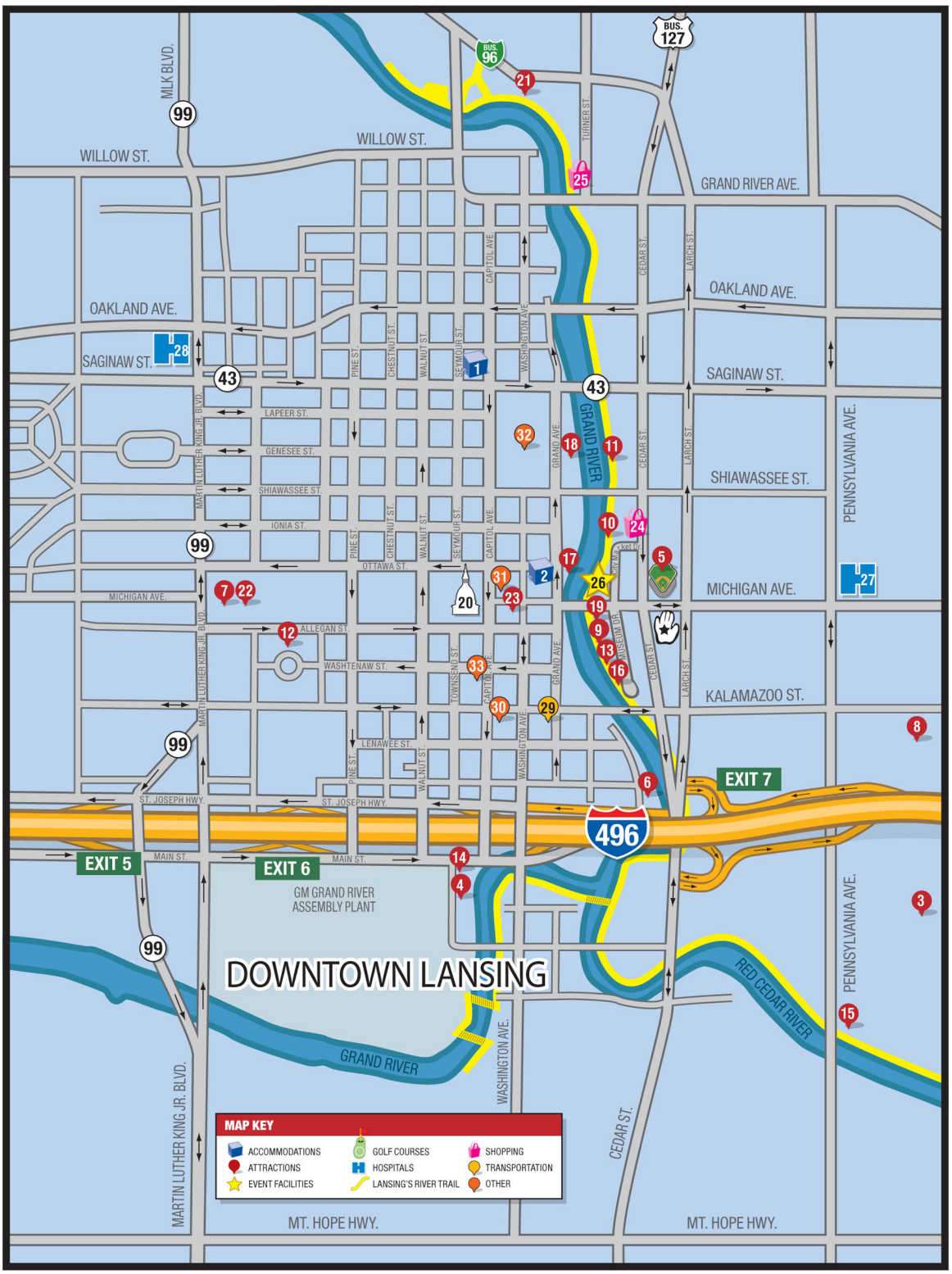
THEATRES

- *The Riverwalk Theater*, *the Lansing Civic Players*, and *the Boars Head Theater* are located in downtown Lansing.
- *The Wharton Center for Performing Arts* at Michigan State University. The Center is on the campus of MSU and is home of the Lansing Symphony Orchestra.

Libraries

- *The Library of Michigan and historical Center*. The library is a top five genealogical research center in the United States.
- *Michigan State University Libraries*

Map of Downtown Lansing, Michigan



Downtown Lansing

1. Cozy Koi Bed & Breakfast
2. Radisson Hotel Lansing at the Capitol
3. All Around the African World Museum
4. Cooley Gardens
5. Cooley Law School Stadium
6. The Grand Fish
7. Hall of Justice and Michigan Supreme Court Learning Center
8. Hunter Park GardenHouse
9. Impression 5 Science Center
10. Lansing Metro Marinas
11. Lansing's River Trail (yellow line on map)
12. Michigan Historical Center
13. Michigan Society of Professional Surveyors Institute
14. Michigan Women's Historical Center and Hall of Fame
15. Potter Park Zoo
16. R. E. Olds Transportation Museum
17. Remembrance Memorial
18. Riverfront Park
19. Riverwalk Theatre
20. State Capitol Building
21. Turner-Dodge House
22. Vietnam Veterans Memorial Monument
23. Washington Square and Michigan Walk of Fame
24. Lansing City Market
25. Old Town Historic District
26. Lansing Center
27. E. W. Sparrow Hospital Campus
28. St. Lawrence Hospital Campus
29. CATA Transportation Center
30. Capital Area District Library
31. Lansing City Hall
32. Lansing Community College
33. Thomas M. Cooley Law School

Visitor Center

For more information on how to find exciting places in Lansing and the surrounding area, call the Greater Lansing Convention & Visitors Bureau at (517) 487-6800.

500 E. Michigan Ave., Suite 180, Lansing, MI 48912
Phone: (517) 487-6800 • (888) 2-LANSING (526746) • FAX: (517) 487-5151

Map of Michigan State University